

**Deliver ECI Version of Desert Hammer VI Data
Collection Instruments and User Training**

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13. ABSTRACT (Maximum 200 words) This report summarizes the development of the ECI to support DESERT HAMMER VI data collection. Software and hardware aspects of the ECI, OC training and support, and ECI data manipulation are addressed. Also included are problems and advantages within the system and processes. The Electronic Collection Instrument (ECI) had previously been used during an NTC Rotation from 7-21 August 1993. During this field trial, the ECI was used by OCs to collect checklist, statistical, and Take Home Package data. The NTC leadership, impressed with the OCs ability to collect data with the ECI, selected the system as the vehicle for DESERT HAMMER VI electronic data collection. The ECI was a research and development program sponsored by the Defense Institute for Training Resource Analysis (DITRA). The ECI originated from research designed to develop and test a prototype Performance Automated Measurement System (PAMS). PAMS was adopted by the U.S. Army in April 1993 and was subsequently renamed the Electronic Collection Instrument (ECI) for Army use.				
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DELIVER ECI VERSION OF DESERT HAMMER VI DATA COLLECTION INSTRUMENTS AND USER TRAINING

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DELIVER ECI VERSION OF DESERT HAMMER VI DATA COLLECTION INSTRUMENTS AND USER TRAINING

I. INTRODUCTION

A. Background

The Army Research Institute for the Behavioral and Social Sciences (ARI) has the mission of developing the Combat Training Center Archive (CTC Archive). This Archive holds data on the performance of units engaged in simulated combat as part of the Battle Command Training Program and at the Combat Training Centers (CTCs).

The projected period of performance included a special Rotation at the NTC. This Rotation was designed to examine the effects of enhancing elements of one task force with digital equipment and other electronic systems to improve unit performance in combat. This Rotation, known as DESERT HAMMER VI, included certain 'experiments' which increased the volume of data and introduced many new data reporting systems and formats.

The Center for Army Lessons Learned (CALL) requested that ARI-POM develop a 'baseline' of performance for comparison to 94-07. Special data collection efforts were performed for three rotations (94-05, 94-06, and 94-08) as well as during 94-07. The Mounted Warfighting Battlespace Laboratory (MWBL) and the Directorate of Combat Development (DCD) at Ft. Knox performed a front-end analysis to identify the types of information which would reveal the impact of the new equipment. These two agencies, in cooperation with the OCs at the NTC, designed data collection instruments to capture the information needed for analysis. Data collection by the OCs with electronic systems was scheduled to occur only during three Rotations (94-06, 94-07, and 94-08).

The Electronic Collection Instrument (ECI) had previously been used during an NTC Rotation from 7-21 August 1993. During this field trial, the ECI was used by OCs to collect checklist, statistical, and Take Home Package (THP) data. The NTC leadership, impressed with the OCs ability to collect data with the ECI, selected the system as the vehicle for DESERT HAMMER VI electronic data collection.

The ECI was a research and development program sponsored by the Defense Institute for Training Resource Analysis (DITRA). The ECI originated from research designed to develop and test a prototype Performance Automated Measurement System (PAMS). PAMS was adopted by the U.S Army in April 1993 and was subsequently renamed the Electronic Collection Instrument (ECI) for Army Use.

B. Objective

This report summarizes the development of the ECI to support DESERT HAMMER VI data collection. Software and hardware aspects of the ECI, OC training and support, and ECI data manipulation are addressed.

II. OC TRAINING AND SUPPORT

ARI-POM and BDM coordinated with the NTC Observation Department (NOD) and the NTC Operations Group starting in January 1994 to determine ECI usage, training, and support requirements for DESERT HAMMER VI. Coordination resulted in the determination of OC participants and Rotation schedules, data collection requirements, and training and support requirements.

A. OC Participants & Rotation Schedules

The NTC initially scheduled forty OCs to participate in the ECI data collection effort; twenty from the Armor Task Force Training Team (COBRAS) and twenty from the Task Force Live Fire Training Team (DRAGONS). See ANNEX A for the breakout of OC participants.

The COBRA Team and the DRAGON Team adjusted the number of their participants for Rotations 94-06, 94-07, and 94-08. Adjustments were made prior to the start of each rotation based on applicability of Digital Difference Cards to the OCs, OC losses and changes during the three rotations, and on OC interest in data collection to support the DESERT HAMMER VI data base.

NTC Rotation dates for ECI support of DESERT HAMMER VI were as follows:

Rotation 94-06	6 - 19 March 1994
Rotation 94-07	10 - 23 April 1994
Rotation 94-08	8 - 12 May 1994

The week preceding each rotation was used to schedule OC Training and distribution of ECIs. The week following each rotation was used to collect the ECI's to download data, perform software updates, and to prepare the systems for the next rotation.

B. Data Collection

The NTC Operations Group developed "Digital Difference Cards" for the collection of DESERT HAMMER VI data. The same Digital Difference Card were used for manual and ECI data collection. Forty-six (46) Digital Difference Cards were loaded into the ECI by BDM-POM.

In order to move ECI-collected data from the OCs in the field to the DESERT HAMMER VI data base located in the NTC-NOD building, data was downloaded onto diskette by the OCs. The COBRA and DRAGON Teams collected the ECI diskettes after every mission and physically delivered them to the Training and Analysis Feedback (TAF) Center. From the TAF, BDM representatives physically transported the diskettes to the NTC-NOD building for downloading into the DESERT HAMMER VI data base.

Data collection during Rotation 94-06 was performed by thirty-seven OCs. Of the initial forty OCs, three were not required to collect data on the Digital Difference Cards. OCs using the ECI also completed manual collection cards. Rotation 94-06 was the first large scale field trial of the ECI and its software, OCs collected data using manual cards as well as the ECI to verify ECI reliability.

Data collection during Rotation 94-07 was performed by thirty-two OCs. Eight of the initial forty OCs did not collect data, either because they did not have collection requirements or because of a lack of time or interest. The COG demonstrated the ECI to the U.S. Army Chief of Staff at the end of the rotation.

The NTC Operations Group lifted the requirement to have the COBRA and DRAGON Teams use twenty ECIs each during the Rotation 94-08, instead allowing each team to use as many ECIs as they wanted to. As a result of this decision, only six OCs collected data using the ECI.

C. ECI Interface with OCCS

The NTC identified the desire to have ECI-collected data transmitted over the Observer-Controller Communications System (OCCS). Several advantages would be realized by this capability. It would allow DESERT HAMMER VI data to be quickly integrated into the data base for rapid analysis without requiring OCs to physically transport the data, a time-consuming process. Additionally, with DESERT HAMMER VI designed to explore the impact of digital systems on the modern battlefield, NTC would be able to take advantage of technological advances to test systems which would advance the CTC's performance capabilities.

In late 1994 January BDM initiated coordination with High Desert Communications, Comtronix Communications, and Advanced Digital Sensing Laboratories (ADSL) to determine

hardware and software requirements to transmit data over OCCS. A BDM team met these representatives at NTC on 11 March to work on and demonstrate the transmission of ECI DESERT HAMMER VI files over OCCS via modem.

NTC supported this initial test by providing an OCCS base station and an OCCS-equipped vehicle. Two days were spent testing the ECI-modem-OCCS connectivity; eventually files smaller than 2k bytes were transmitted. Hardware modifications to two modems were required and performed by the Comtronix and ADSL representatives. Documentation on software and hardware modifications was provided to BDM by Comtronix and ADSL.

Due to the size of the ECI DESERT HAMMER VI files, it was necessary to conduct further testing to increase file size and reliability of data transmission. ECI and modem software was purchased and configured in mid-March. Continued testing was not possible until the period between Rotations 94-06 and 94-07 due to restricted access to OCCS systems.

On 8 April a three-person BDM team conducted further testing at the NTC. The intent of the testing was to replicate the success achieved in March with the transmission of data over OCCS, to test the transmission of larger files, and to prepare five modems and the OCCS for use during Rotation 94-07. The team was unable to replicate the transmission test using the hardware and software documentation provided by Comtronix and ADSL. Further investigation determined that the Comtronix representative had provided incomplete hardware and software documentation identified during the March test.

The BDM representative providing on-site technical support for the Rotation 94-07 continued to work the software and hardware issues. By 20 April success had been achieved in transmitting ECI files by modem over OCCS. Several files were successfully transmitted during the test, with all Digital Difference data received and loaded into the DESERT HAMMER VI SPSS/FOXPRO data bases. Although the transmission of ECI data had been achieved during controlled testing, the capability to transmit ECI data was not tested during 94-07 and 94-08.

C. Training & Support

1. Rotation 94-06 (March)

OC training and equipment distribution were performed by a three-person BDM team 28 February to 3 March. Training was performed in a classroom environment over a two day period. One day each was dedicated to training the COBRA Team and the DRAGON team.

Each OC trained used the ECI they would have during the rotation. Following formalized classroom training, individual one-on-one training sessions were conducted with each participant. Forty OCs were trained, twenty from each team. Users were instructed on

the assembly and use of the ECI, the Digital Difference Card programs, and the ARTEP Reader.

On-site technical support for Rotation 94-06 was provided by a BDM representative, providing programming and hardware support. On two occasions the on-site technician went to the field to interview OCs on the ECI's performance as well as to provide replacement components.

Software and hardware problems identified during the rotation were corrected by the on-site technician. During interviews with each user throughout the rotation, the technician was able to assess ECI performance and respond immediately to any identified bugs or problems. Those software problems which affected all ECI systems were cataloged and the software program was modified to correct the fault. Due to the intensity of the rotation, software updates required for all systems were scheduled to occur at the end of the rotation.

Data collected by the ECI was downloaded onto diskettes and transported from the field to the TAF by the OC teams after each mission. The diskettes were then picked up by a BDM representative and delivered to the DESERT HAMMER VI data base in the NTC-NOD building.

Interviews with the OCs were conducted at the conclusion of the March Rotation to determine ECI software and hardware performance. During these interviews numerous small bugs, predominately dealing with saving and down-loading data, were identified. Problems were also experienced with the downloading of data into the DESERT HAMMER VI SPSS/FOXPRO data base. The ECIs were collected at the end of the interviews. Software bugs were corrected during the break between the March and April rotations, from 23-31 March.

2. Rotation 94-07 (April)

Refresher training for OCs was performed 4-8 April. Digital Collection Cards, the ARTEP Reader, and software modifications were reviewed. OCs utilized their re-configured ECIs during the training, and signed for their systems at the conclusion of training. The Commander - Operations Group (COG) requested one ECI for display purposes, and his driver was trained on the system.

During the April rotation, on-site technical support was provided by a representative from BDM. The on-site technician was located in the NTC NOD building and provided programming and hardware support.

The BDM technician met with OCs in the field following each mission, picked up ECI diskettes which contained the mission data, and transported the diskettes to the DESERT HAMMER VI Analysis Cell for downloading. While meeting with the OCs, the on-site technician also provided assistance, support, and component exchange.

Following the April Rotation, interviews were conducted with the users. Interviews covered the ECI's ability over two rotations to collect and transfer data into the DESERT HAMMER VI data base.

The ECIs were collected from the OCs at the conclusion of the April rotation. Software modifications not corrected by the on-site technician during the Rotation were performed between 25 April to 3 May.

3. Rotation 94-08 (May)

No refresher training was conducted with the NTC OCs prior to the May Rotation, OCs felt familiar with the system. On-site support was provided by the BDM representative stationed at Fort Irwin. Since data transmission over OCCS was not conducted, the OCs continued turning in diskettes at the conclusion of each mission through their TAF to the DESERT HAMMER Analysis team.

At the conclusion of the May field trial, the ECIs were collected and transported to BDM-POM for data download.

III. ECI SOFTWARE DEVELOPMENT

A. Software Background

The ECI software used during the NTC August 1993 field trial was DOS/Character based, in Clipper/Advanced Revelation Language. The program was composed of two elements; a data collection module to be used in the field by the end user and a data assimilation/reporting module to be used in a 'home base' situation.

Interviews with the OCs were conducted following the Rotation to determine optimum software characteristics. Their comments were used as reference the re-write of the software into Graphical User Interface and Windows. The rewrite provided the ECI with interconnectivity to and communication with other Windows based programs, such as spreadsheets, databases, and word processing programs.

A separate software program was written following the August 93 field trial to integrate doctrinal FMs and ARTEP MTP's into the ECI through an ARTEP Reader. The ARTEP Reader provided users access to doctrinal manuals for review and allowed "cut and paste" from manuals to data collection forms. This capability provided OCs during DESERT HAMMER VI with the ability to provide doctrinal support to the data they collected.

B. Desert Hammer VI Software

ECI software was developed to allow collected data to be transferred and incorporated into the DESERT HAMMER VI SPSS/FOXPROM database. NTC data collection forms were structured and loaded into the ECI software beginning in January 1994.

Data collection software was updated to allow information transfer from the ECI into the DESERT HAMMER VI data base. Beta testing was performed by BDM-POM starting in February 1994. The ECI software was updated based on beta test results, and was ready for use by the first DESERT HAMMER VI baseline Rotation in March (94-06).

IV. ECI HARDWARE DEVELOPMENT

A. Hardware Background

Four different off-the-shelf laptop computer brands were used as the ECI hardware platform during the NTC August 1993 field trial. Those systems were: Sharp computers, model PC-6881; Grid computers, model 2260; Zenith computers, model Z-Lite 320L; and Tusk, hardened 386 computer.

OC HUMMV's were modified with a power plug to allow the computers to run off vehicles batteries and to charge computer batteries. The Tusk computer, the only hardened system used, failed during the first half of the field trial and was replaced with a back-up Sharp computer for the remainder of the field trial.

Interviews with the OCs were conducted following the Rotation to determine optimum hardware characteristics. Their comments were used as a guide for the selection of the hardware platform for DESERT HAMMER VI data collection.

B. Desert Hammer VI Hardware

In January 1994 one common computer model was selected to serve as the ECI platform during DESERT HAMMER VI data collection. This decision was made to facilitate user training, reduce hardware costs, and streamline hardware repair requirements. A review of off-the-shelf portable computers was performed by ARI and BDM-POM. The Dauphin DTR-1 was selected due to its characteristics: compact size; 486 SLC 25 MHz microprocessor; 6 MB of dynamic RAM; and a built-in 40 MB Hewlett-Packard hard drive. Forty Dauphin DTR-1's were purchased to support DESERT HAMMER VI. OC HUMMV's were modified with power connectors to allow operation of the ECI from vehicle power and to charge laptop batteries.

Due to an overlap in scheduled Rotations at JRTC and NTC in March 1994 (94-06), a distribution plan was developed to support both trials. Twenty-five systems were retained at NTC. Twenty systems were provided to the COBRA Team, turned over to the DRAGON Team as the rotational Armor Task Force transitioned for Live Fire, and returned to the COBRA Team when the Armor Task Force returned at the conclusion of Live Fire. The NTC requirement to have forty users participate in the March field trial was satisfied by this distribution plan. Five systems were available as back-ups.

During Rotations 94-07 and 94-08, all forty systems were available at the NTC. Based on the reduced OC commitment during 94-07 and 94-08 from the COBRA Team and DRAGON Teams, a number of ECI's were available as back-ups.

With ECIs distributed in April and May, priority was given to the on-site repair of the systems in the event of computer hardware breakdowns. If on-site repair could not be accomplished, the DTR-1 was returned to the manufacturer for repair and the user was provided with one of the back-up ECIs.

V. CONCLUSION

DESERT HAMMER VI data collection was supported by the ECI during all three target Rotations (94-06, 94-07, and 94-08). Although NTC initially selected forty OCs to participate in data collection with the ECI, this number decreased with each succeeding rotation.

One major advantage of ECI use supporting the DESERT HAMMER VI data base that was not pursued was the transmission of data over the OCCS. This capability was available in time for Rotation 94-08. Had the NTC supported this aspect, data could have been quickly transmitted and loaded into the data base, allowing for rapid analysis.

Problems were experienced with the system of physically transporting diskettes from the field to the NTC-NOD for entry into the data base. These problems were due primarily to the distances involved and conflicting mission requirements placed on the OCs.

The ECI software did experience problems during Rotation 94-06, however these problems were focused on the downloading of information and not on the physical collection of data. These problems were corrected prior to Rotation 94-07. Additionally, the on-site BDM representative was able to correct software and hardware problems experienced by individual OCs during succeeding Rotations.

The NTC OCs did not express a time or effort savings between collecting data with the ECI versus a manual collection system, however time savings were realized with the downloading and analysis of data once the ECI diskettes were provided to the DESERT HAMMER VI analysts. The average time required by DESERT HAMMER VI analysts to

input one manual Digital Difference Card into SPSS/FOXPRO was five minutes. For the uploading of ECI collected data, approximately two minutes were required.

Had all OCs participating in ECI data collection turned in data on the forty-six cards loaded into the ECI, analysts could have realized a time savings of 1.5 to 2.25 hours per TF per mission by using ECI collected data. A focused study on time savings provided by the use of ECI over the loading of manual collected data was not conducted because of the size of the data collection effort and the limited number of data analysts.

APPENDIX A

(March-May 94 NTC Field Trial O/C breakdown)

Note: Rank and position structure listed below represents one O/C Team. Forty participants were involved, twenty from the COBRA Team and twenty from the DRAGON Team.

- COL/LTC - Senior Task Force Trainer
- Major - Task Force XO Trainer
- Major - Task Force S3 Trainer
- Captain - TF TOC Trainer
- Captain - S4 Trainer
- Captain - S2 Trainer
- Captain - HHC Trainer
- Captain - Engineer Trainer
- Captain - ADA Trainer
- Captain - Scout Platoon Trainer
- Captain - Medical Platoon Trainer
- Captain - Maintenance Trainer
- Captain - FSO Trainer
- Captain - S1 Trainer
- Captain - Armor Company Trainer
- Captain - Armor Company Trainer
- Captain - Mechanized Infantry Company Trainer
- Captain - Mechanized Infantry Company Trainer
- Captain - Company Trainer
- SFC - Mortar Platoon Trainer